Sensitivity Analysis

This Agent Based model mainly focuses on Flood Risk Management based on agent interactions. The model runs for 3 different flood risk levels, Low risk, moderate risk and high risk. Each risk level monitor,

- Flood spread areas over time
- No. of waters spread areas
- No. of initial low risk areas (where the flood begins)
- No. of humans evacuated to nearest buildings
- No. of humans leave the area (self-evacuations)
- No. of humans' dead
- Time for human evacuation
- Property damage estimate
- Water level spread over time

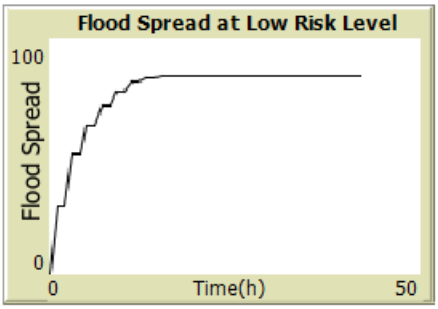
At the low risk level, properties and humans are barely affected by the flood, so people continue their daily lives. At the moderate risk level, the damage level is considerably higher, and people begin to self-evacuate, with some leaving the area. At the high-risk level, the flood spreads throughout the entire area, causing significant damage to properties and humans. People in high-risk areas evacuate to the nearest safe buildings, while some leave the area altogether. Responders save and evacuate people in the buildings to another safe place outside the area. The model estimates total damage based on the number of buildings affected by the flood and the reduced sea damage level. When the human population changes, all other factors change accordingly. Furthermore, the flood water level is based on river height, lake height, and rainfall level. Key factors of this model are,

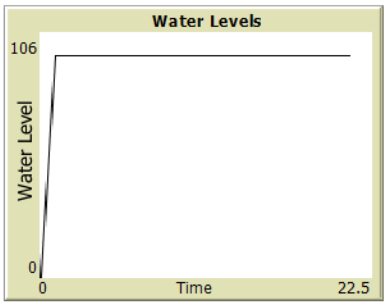
- Human population (100-500)
- Rainfall level (1-10)
- River height (0-100)
- Lake heights (0-100)
- Sea damage reduces (0-10)

This sensitivity analysis provides valuable insight for flood risk management. This study will analysis Sensitivity of the model one at a time for each risk level. It will help to identify the individual effect of each parameter on the model output.

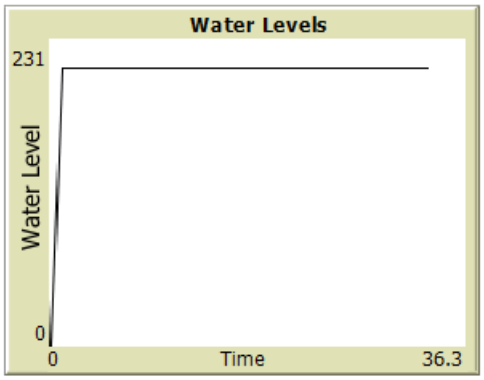
➢ Low Flood Risk Level

At the low risk level, the flood covers 6-8% of the ground after 15-20 hours, causing damage of nearly 15,000. The water level reaches a maximum of 90-100 cm after 2-3 hours. Since people continue their daily lives at the low risk level, the human population doesn't influence any other factors.



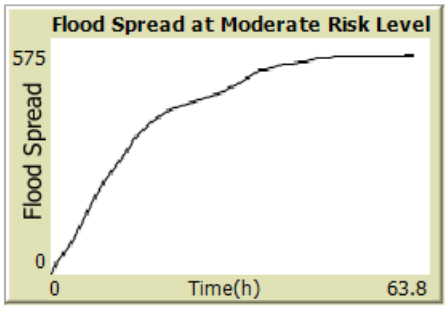


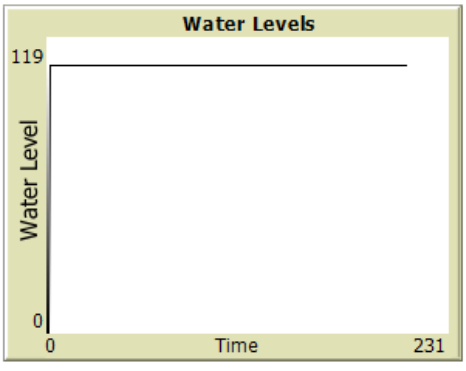
As the river height, lake height, and rainfall level increase, the water level reaches a maximum of 200-210 cm in 1-2 hours, with estimated damage over 2000.



➢ Moderate Flood Risk Level

At the moderate risk level, the flood covers (30-40)% of the ground after (40-48) hours, causing damage of nearly 50,000. The water level reaches a maximum of (105-110) cm after (2-3) hours. At the moderate risk level, people tend to evacuate by leaving the area and going to safe buildings. This takes nearly 46 hours in this scenario. As the population increases, the evacuation time becomes longer due to the crowd.

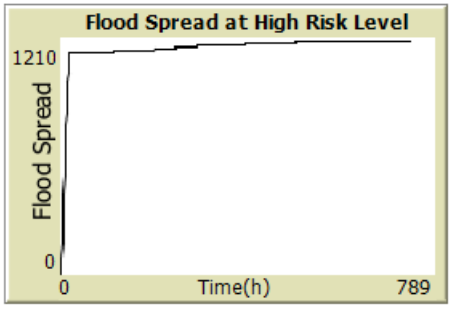


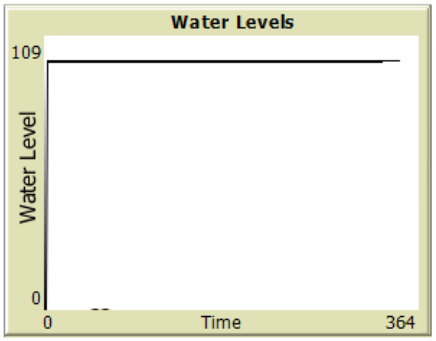


As the river height, lake height, and rainfall level increased, the water level rose, causing more damage compared to the previous scenario.

➢ High Flood Risk Level

At the high risk level, the flood covers (80-90)% of the ground after 20-25 hours, causing damage of nearly 10,0000. The water level reaches a maximum of 109 cm after 2-5 hours. At the high risk level, people tend to evacuate by leaving the area and going to safe buildings. This takes nearly 119 hours including boat evacuations (72 hours) when the population is 320. As the population increases, the evacuation time becomes over 130 hours due to the crowd.





As the river height, lake height, and rainfall level increased, the water level rose, causing more damage over 200000 compared to the previous scenario and evacuation took longer than 140 hours.

Note that sea damage is subtracted from the total damage when only the sea is present.

Conclusion.

The floods differently affect damage and evacuation as shown by the sensitivity analysis of this ABM. The impacts start with low values at the low danger level but get higher with increased risks resulting in more damage and longer evacuations. A significant rise in overall damage is caused by increasing river levels, lake levels, and rainfall, which makes even more difficult evacuation plans. Thus, according to this model flood risk control must take into consideration human population density, environmental conditions and flood parameters. These strategies can enhance solutions for optimizing flood management in diverse risk cases.